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GLOBAL CLIMATE OBSERVING SYSTEM (GCOS)

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Session 1

GRUAN Site Report for Boulder

(Submitted by Dale Hurst)

Summary and Purpose of this Document

Report from the GRUAN site Boulder for the period January to December 2019.

Overview

The Boulder GRUAN site continued to launch Vaisala RS41 radiosondes along with our weekly ozone sounding payload (EnSci model 2Z ECC ozonesonde and InterMet model RS-1 radiosonde) and our monthly ozone and water vapor sounding payload that also includes a NOAA frost point hygrometer (FPH) from the Marshall Field Site. Data from all these sondes were submitted to GRUAN for processing, quality control and archival.
The GFZ-Potsdam-owned GNSS receiving system (TMS3) located at the NOAA Table Mountain facility near Boulder is now providing data to GRUAN. We are still awaiting approval from the manager of the Marshall Field Site (property of NCAR) to move TMS3 from Table Mountain to Marshall, as it would be optimal to have this GNSS receiving system co-located with the sonde launching site at Marshall. NCAR is concerned that there is nobody who will look after TMS3 once it is moved because the instrument belongs to GFZ-Potsdam.
Please note that the Global Monitoring Division is now known as the Global Monitoring Laboratory (GML) and is part of the NOAA Earth System Research Laboratories (NOAA/ESRL).

Change and change management

There were no changes to any aspect of the Boulder GRUAN radiosonde launches during 2019. The last change in soundings that occurred was the switch from RS92 to RS41 radiosondes in December 2017. Although I am not absolutely sure, the flow of GNSS data from TMS3 (part of the dispersed Boulder GRUAN site) most likely started in 2019 when it was determined that P041 was not going to be part of the Boulder site because its owners and operators have no interest in GRUAN.

Resourcing

As in previous years, NOAAs budget remained flat while operating costs increased. The US presidential election in November 2020 may have a significant impact on the NOAA/ESRL/GMLs ability to continue operating and managing the Boulder GRUAN site. We hope for the best outcome.

Operations

Unlike for our ozone soundings, where balloons are allowed to reach the burst point, our FPH soundings continue to include a valve in the balloon neck that starts to release helium from the balloon at about 16 hPa, preventing burst, allowing controlled descent of the balloon, and permitting contamination-free stratospheric water vapor measurements by the FPH. Hence, by design, about 25 % of our

soundings will not reach 10 hPa. In 2019 we also experienced some balloon quality problems that caused about 20 % of the ozone soundings to not reach 10 hPa.

Site assessment and certification

The Boulder GRUAN site has already been certified and recertified.

GRUAN-related research

I contribute to GRUAN by serving as a co-chair of the Task Team of Site Representatives, a member of the Working Group GRUAN, and the Boulder site representative.
The Boulder site will be investigating the use of a dry ice + ethanol cold bath as the coolant for the NOAA Frost Point Hygrometer thanks to a CIRES innovative research grant awarded in late 2019.
I was a co-author on three peer-reviewed papers published in 2019 that have scientific connections to GRUAN:

- Lossow, S., F. Khosrawi, M. Kiefer, K.A. Walker, J.-L. Bertaux, L. Blanot, J.M. Russell III, E.E. Rems-berg, J.C. Gille, T. Sugita, C.E. Sioris, B.M. Dinelli, E. Papandrea, P. Raspollini, M. Garca-Comas, G.P. Stiller, T. von Clarmann, A. Dudhia, W.G. Read, G.E. Nedoluha, R.P. Damadeo, J.M. Zawodny, K. Weigel, A. Rozanov, F. Azam, K. Bramstedt, S. Nol, J.P. Burrows, H. Sagawa, Y. Ka-sai, J. Urban, P. Eriksson, D.P. Murtagh, M.E. Hervig, C. Hgberg, D.F. Hurst, and K. H. Rosenlof, The SPARC water vapour assessment II: Profile-to-profile comparisons of stratospheric and lower mesospheric water vapour data sets obtained from satellites, Atmos. Meas. Tech., 12, 2693-2732, doi:https://www.doi.org/10.5194/amt-12-2693-2019, 2019.

- Ortega, I., R.R. Buchholz, E.G. Hall, D.F. Hurst, A.F. Jordan, and J.W. Hannigan, Tropospheric water vapor profiles obtained with FTIR: comparison with balloon-borne frost point hygrometers and influence on trace gas retrievals, Atmos. Meas. Tech., 12, 873-890, doi:https://www.doi.org/10.5194/amt-12-873-2019, 2019.

- Davis, S.M., K.H. Rosenlof, D.F. Hurst, H.B. Selkirk, and H. Vmel, Stratospheric Water Vapor [in "State of the Climate in 2018"], Bull. Amer. Meteor. Soc., 100 (9), S56-S58, doi:https://www.doi.org/10.1175/2019BAMSStateoftheClimate.1, 2019.

WG-GRUAN interface

No special assistance or support by the WG is required at this time.

Other archiving centers

Ozone and water vapor sounding data from Boulder are archived on the NOAA/GML anonymous FTP server `ftp://aftp.cmdl.noaa.gov/data/ozwv/`, the NDACC public data ftp server `ftp://ftp.cpc.ncep.noaa.gov/ndacc/station/boulder/ames/` and at NOAAs National Centers for Environmental Information (NCEI) in Asheville, North Carolina.

Participation in campaigns

There were no campaigns conducted at the Boulder GRUAN site during 2019. There were ozone and water vapor soundings performed in coordination with overpasses of Boulder by the Stratospheric Aerosols and Gas Experiment III instrument aboard the International Space Station (SAGE III/ISS). The ECC and FPH profiles are being used to validate the SAGE III/ISS ozone and water vapor data products. Data from all of these soundings have been submitted to GRUAN if a RS41 was included in the payload.

Future plans

Our plan for 2020 is to stay the course, hope that a safe and effective COVID-19 vaccine is on its way, and pray for a change of administration in the USA.

GRUAN Site Report for Boulder (BOU), 2019

Reported time range is Jan 2019 to Dec 2019
Created by the Lead Centre
Version from 2020-11-05

1 General GRUAN site information

Object	Value
Station name	Boulder
Unique GRUAN ID	BOU
Geographical position	39.9500 °N, -105.2000 °W, 1743.0 m
Operated by	GMD | Global Monitoring Division, part of: ESRL | Earth System Research Laboratory, part of: NOAA | National Oceanic and Atmospheric Administration
Main contact	Hurst, Dale F.
WMO no./name	-
Operators	currently 5, changes +0 / -0
Sounding Site	1
GNSS	2

1.1 General information about GRUAN measurement systems

System	Name	Type	Setups	Measurements
BOU-GN-01	GNSS Site P041	GNSS	0	not operational
BOU-GN-02	GNSS site TMS3	GNSS	1	operational
BOU-RS-01	Radiosonde Launch Site (Marshall)	Sounding Site	4	48

1.2 General comments from Lead Centre

No comments from Lead Centre.

2 System: GNSS Site P041 (BOU-GN-01)

Object	Value
System name	GNSS Site P041
Unique GRUAN ID	BOU-GN-01
System type	GNSS (GN - GNSS)
Geographical position	39.5658 °N, -105.1139 °W, 1728.8 m
Operated by	GMD | Global Monitoring Division, part of: ESRL | Earth System Research Laboratory, part of: NOAA | National Oceanic and Atmospheric Administration
Instrument contact	Hurst, Dale F.
Started at	2004-02-13
Defined setups	-
Possible streams	-

2.1 Lead Centre comments

2.1.1 Dataflow

No GNSS dataflow to LC has been established yet.

3 System: GNSS site TMS3 (BOU-GN-02)

Object	Value
System name	GNSS site TMS3
Unique GRUAN ID	BOU-GN-02
System type	GNSS (GN - GNSS)
Geographical position	40.0748 °N, -105.1358 °W, 1668.7 m
Operated by	GFZ | Deutsches GeoForschungsZentrum GFZ, part of: HELMHOLTZ | Helmholtz-Gemeinschaft
Instrument contact	Bradke, Markus
Started at	2014-06-20
Defined setups	1 (HOURLY)
Possible streams	-

3.1 Lead Centre comments

No comments from Lead Centre.

4 System: Radiosonde Launch Site (Marshall) (BOU-RS-01)

Object	Value
System name	Radiosonde Launch Site (Marshall)
Unique GRUAN ID	BOU-RS-01
System type	Sounding Site (RS - Radiosonde)
Geographical position	39.9500 °N, -105.2000 °W, 1743.0 m
Operated by	GMD | Global Monitoring Division, part of: ESRL | Earth System Research Laboratory, part of: NOAA | National Oceanic and Atmospheric Administration
Instrument contact	Hurst, Dale F.
Started at	-
Defined setups	4 (RESEARCH, OZONE, FPH-OZONE, FPH)
Possible streams	FPH, IMET-1, RS41, RS80, RS92

4.1 Lead Centre comments

4.1.1 Dataflow

Operational dataflow of radiosonde measurement data to the GRUAN LC since August 2014.

Currently, the dataflow includes radiosoundings with Vaisala RS92-SGP, RS41-SG, Intermet iMET-1, ECC Ozone and FPH. All data are transmitted using the RsLaunchClient within one month after the sounding.

A regular and intensive measurement program for the observation of stratospheric water vapor was performed using FPH.

4.2 GRUAN data products

Product	Version	Soundings received	Available at LC	Distributed by NCEI

4.2.1 Stream: ECC

ECC		47	47	

4.2.2 Stream: FPH

FPH		14	14	

4.2.3 Stream: IMET-1

IMET-1		48	48	
IMET-1-RAW	001		47	

4.2.4 Stream: RS41

RS41		48	48	
RS41-RAW	001		48	
RS41-EDT	001		46	
RS41-GDP-ALPHA	001		7	
RS41-GDP-ALPHA	002		39	
RS41-GDP-ALPHA	003		13	
RS41-GDP-BETA	001		45	

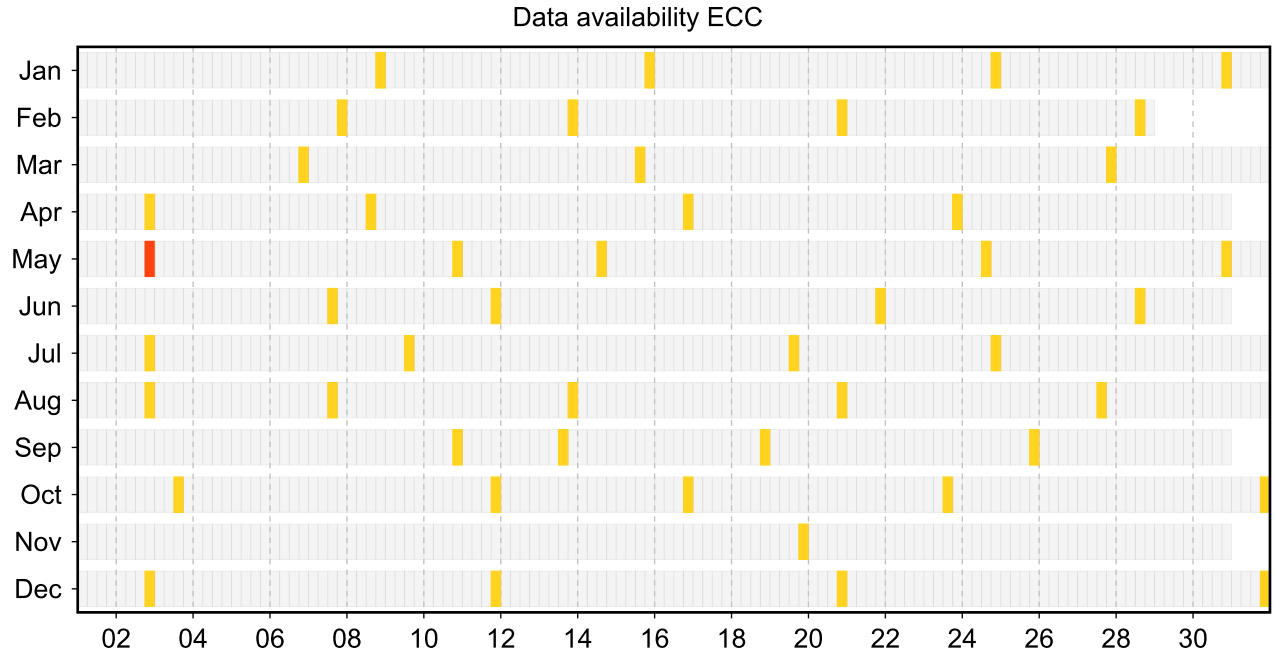
4.3 Availability of data products

Available (green): All steps of data processing have been successfully completed. The data product file is available at LC (e.g. files that didn't pass QA/QC or uncertified GRUAN data products) and/or at NCEI (a certified GRUAN data product file that did pass QA/QC).

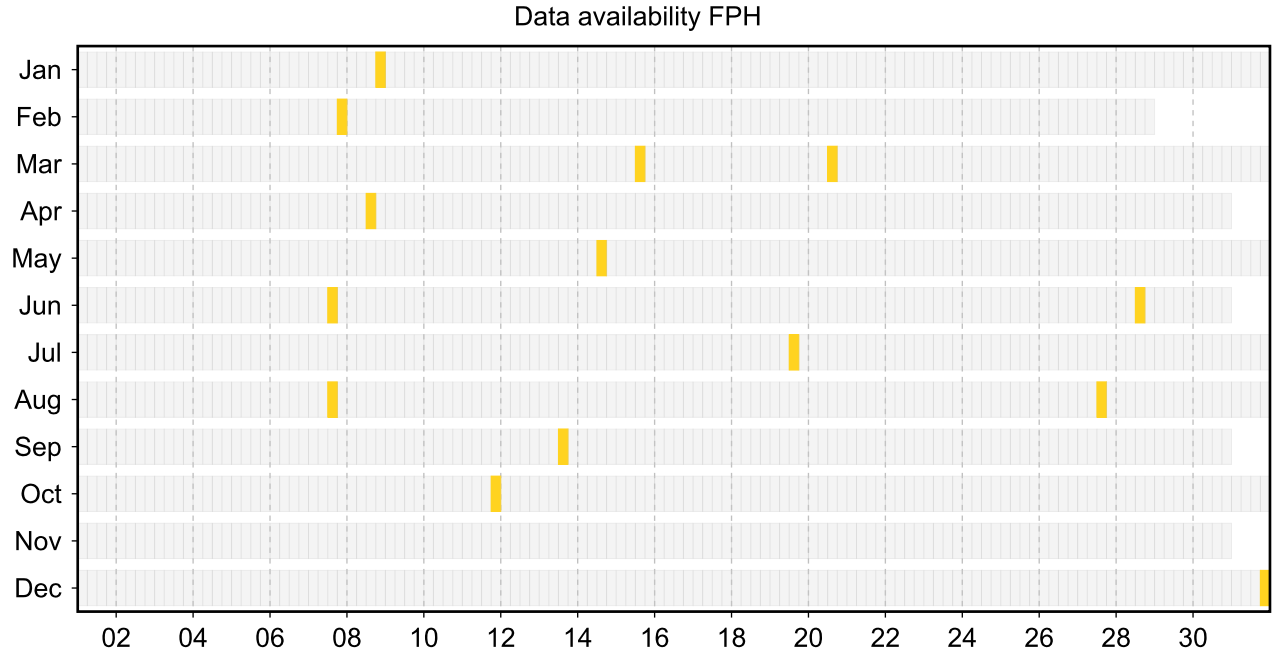
Unprocessed (yellow): The manufacturer-produced file with raw measurement data has been successfully converted into a GRUAN-standardized raw data format (NetCDF). The GRUAN data processing has not been performed or was aborted. Reasons for this may be a still missing GRUAN data processor or a processing-software error.

Original (red): The original, manufacturer-produced, raw data file is available (e.g. MWX data file) but was not converted into a GRUAN-standardized raw data format (NetCDF). Reasons for this may be missing data conversion software, a software error, or a corrupt data file.

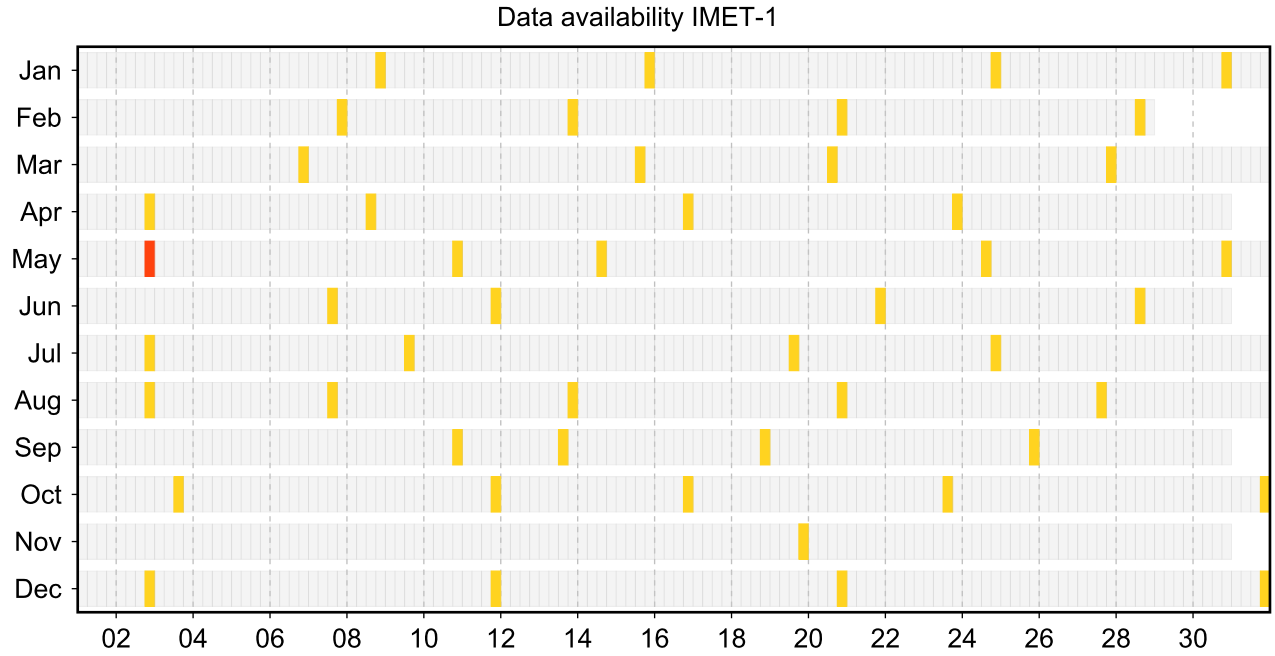
4.3.1 Stream: ECC



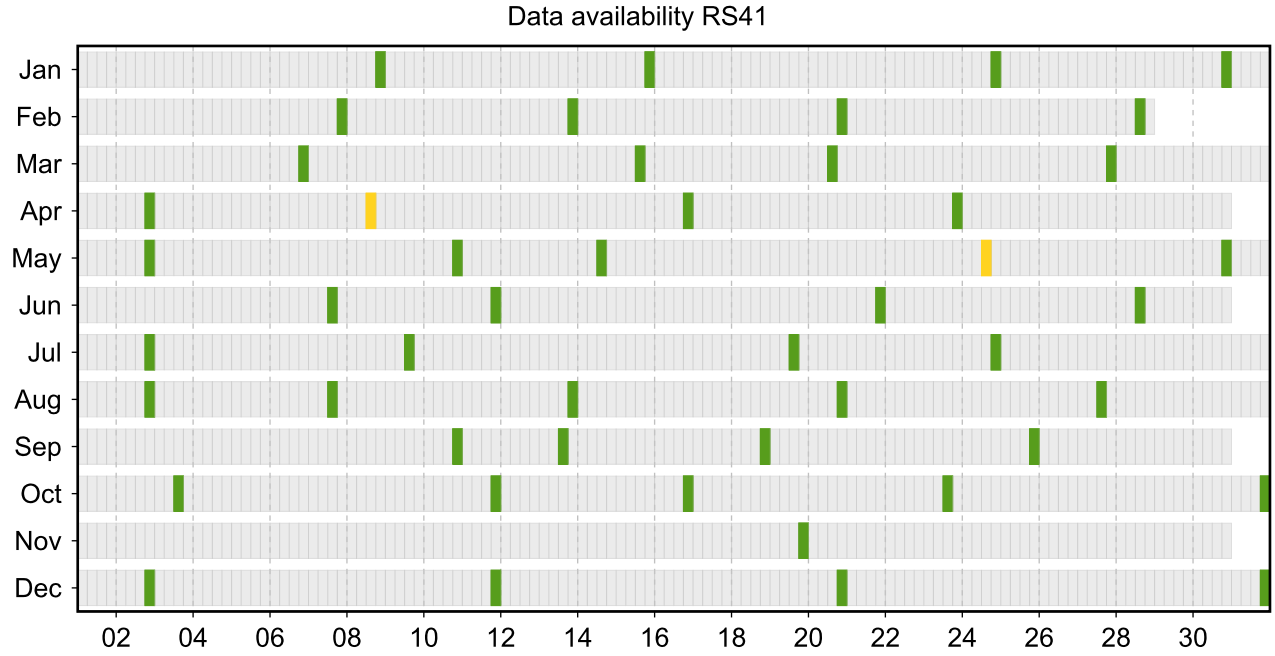
4.3.2 Stream: FPH



4.3.3 Stream: IMET-1



4.3.4 Stream: RS41



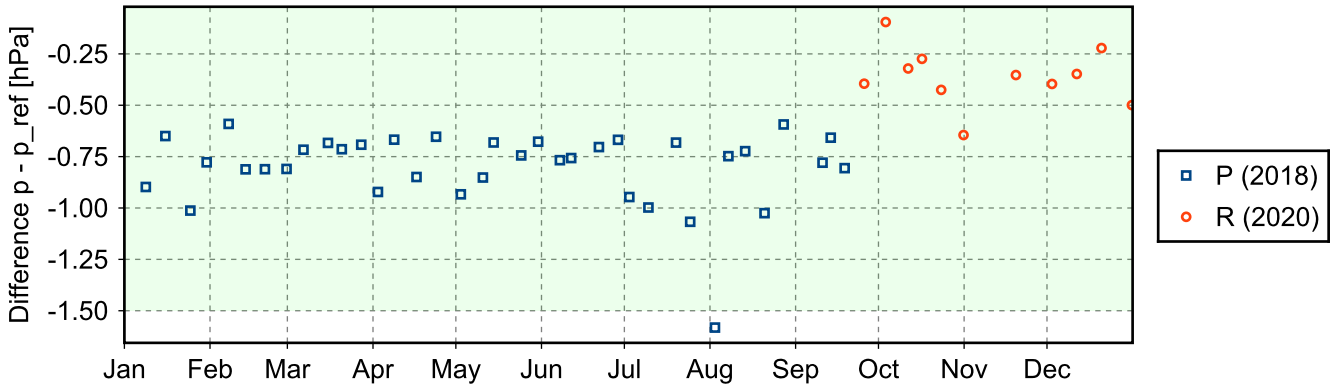
4.4 Instrument combinations of BOU-RS-01

Count	Instrument combination
13	ECC, FPH, IMET-1, RS41
34	ECC, IMET-1, RS41
1	FPH, IMET-1, RS41

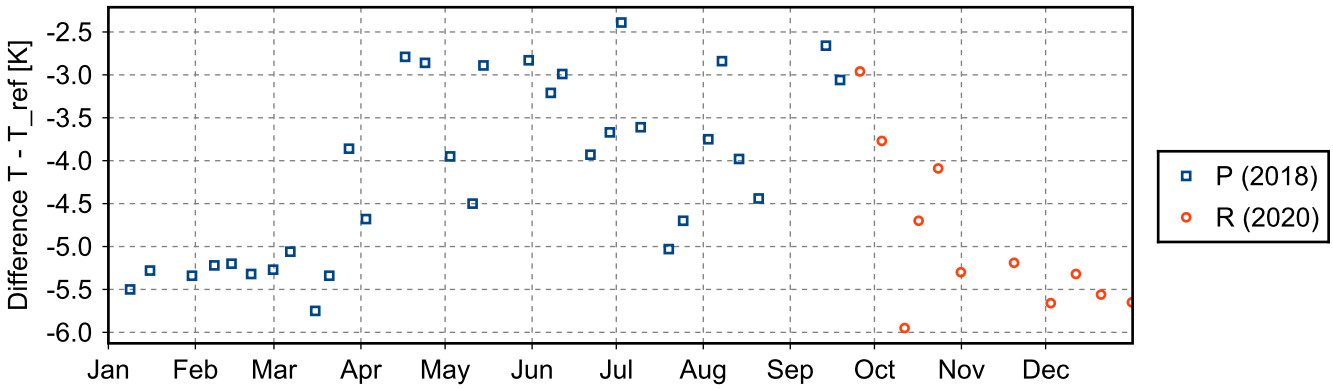
4.5 Instrument ground check

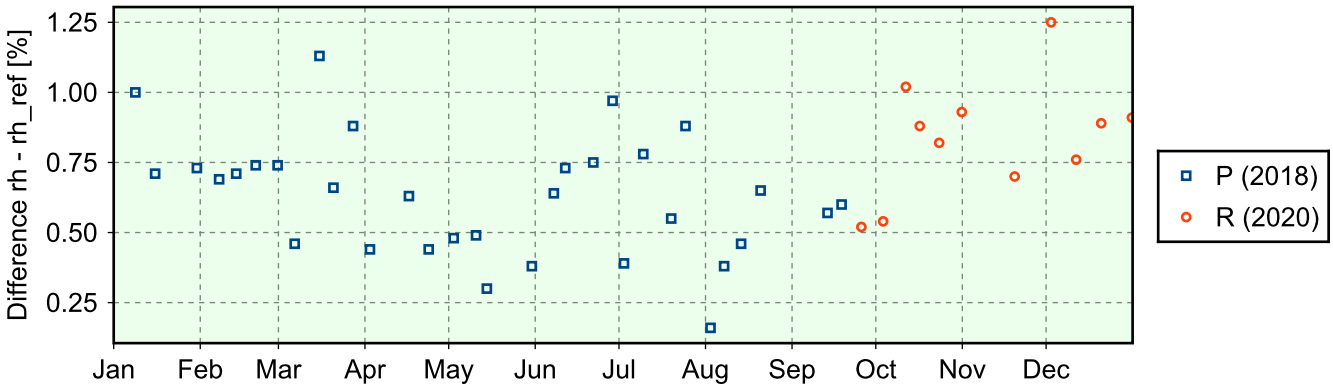
4.5.1 Stream: RS41

(1) GroundCheck: GC-RI41



(2) GroundCheck: GC-SHC





4.6 Measurement events